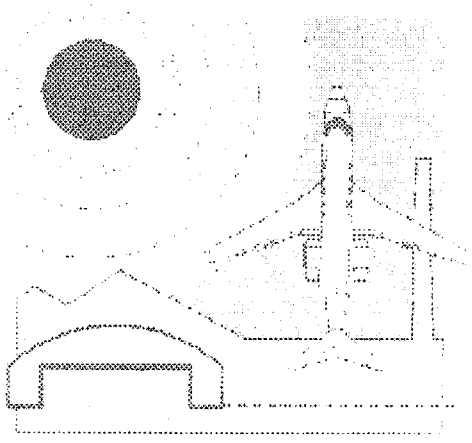
SECTION 3: FORECASTS OF AVIATION ACTIVITY



BISBEE-DOUGLAS INTERNATIONAL AIRPORT
Douglas / Cochise County, Arizona

AIRPORT MASTER PLAN - 1997

SECTION 3:
FORECASTS OF AVIATION ACTIVITY

INTRODUCTION

Forecasts of aviation activity serve as a guideline for the timing required for implementation of airport improvement programs. While such information is essential to successful comprehensive airport planning, it is very important to recognize that forecasts are only approximations of future activity, based upon historical data and from the standpoint of present situations. They therefore must be used with careful consideration, as they may lose their validity through the passage of time. For this reason, an ongoing program of examination of local airport needs, as well as national and regional trends, is recommended and encouraged in order to promote the orderly development of the BDI Airport.

Air Traffic Control personnel maintain records of aircraft operations at towered airports. At airports which are not served by air traffic control towers, estimates of existing aviation activity are necessary in order to form a basis for the development of realistic forecast projections. These estimates are usually based upon a review of available historical data, as well as observations of activity, and contacts with airport users.

Following the development of the estimated current demand, projections are made based upon established growth rates, area demographics, industry trends and other important indicators. Forecasts are prepared for the Initial Term (five-year), the Intermediate Term (ten-year) and the Ultimate Term (fifteen and twenty-year) time frames. Having forecasts within these time frames will allow the construction of airport improvements to be timed to meet demand, but not so early as to remain idle for an unreasonable length of time.

Types of Operations

There are four types of aircraft operations which are considered in the planning process. These are termed local, based, itinerant, and transient. They are defined as follows:

- **Local operations** are defined as aircraft movements (departures or arrivals) for the purpose of training, pilot currency or pleasure flying, within the immediate area of the local airport. These operations typically consist of touch-and-go operations, practice instrument approaches, flights to and within local practice areas, and pleasure flights which originate and terminate at the airport under study.

- **Itinerant operations** are defined as arrivals and departures other than local operations, as described above. This type of operation is closely tied to local demographic indicators, such as local industry and business use of aircraft and usage of the facility for recreational purposes.

- **Based aircraft operations** are defined as the total operations made by aircraft based at the airport under study, with no attempt to classify the operations as to purpose.

- **Transient operations** are defined as the total operations made by aircraft other than those based at the airport under study. These operations typically consist of business or pleasure flights originating at other airports, with termination or a stopover at the study airport.

FAA Aircraft Classifications

Aircraft are grouped by the FAA by wingspan into six *Airplane Design Groups*, and by approach speed into four *Approach Categories.* The airport design criteria and dimensional standards for airport facilities are related to the Airplane Design Groups, Approach Categories, and type of approaches offered, based on the minimum visibility required to legally execute an approach to landing, as follows:

- Visual;

- Instrument with visibility minimums of ¾ mile or greater;

- Instrument with visibility minimums less than ¾ mile.

The six Airplane Design Groups (ADG) and four Approach Categories are categorized in the tabulation below.

FAA AIRPLANE DESIGN GROUPS

ADG I Wingspan up to but not including 49' (ie. Cessna 177, Cessna 210, Piper Cheyenne).

ADG II Wingspan from 49', up to but not including 79' (ie. Cessna Citation II, Gulfstream II, III).

ADG III Wingspan from 79', up to but not including 118'(ie. Boeing 737, Convair 580, Fairchild F-27).

ADG IV Wingspan from 118', up to but not including 171' (ie. Convair 880, Boeing 707).

ADG V Wingspan from 171', up to but not including 197' (ie. Boeing 747).

ADG VI Wingspan from 197', up to but not including 262' (ie. Lockheed C-5A).

FAA AIRCRAFT APPROACH CATEGORIES

Category A Approach speed less than 91 knots (ie. Cessna 182, Beechcraft Bonanza).

Category B Approach speed 91 knots or more but less than 121 knots (ie. Piper Cheyenne, Cessna Citation).

Category C Approach speed 121 knots or more but less than 141 knots (ie. Learjet 25, Rockwell Sabre 75A).

Category D Approach speed 141 knots or more but less than 166 knots (ie. Learjet 35A, Grumman Gulfstream II).

Category E Approach speed 166 knots or more (pertains only to military types).

Source: FAA AC 150/5300-13

FAA Airport Classifications

The FAA classifies airports by the type of traffic they experience, or are designed to accommodate. Each airport is assigned an *Airport Reference Code* (or *ARC*), which is a coding system used to relate airport design criteria to the operational and physical characteristics of the aircraft intended to operate at the airport.

The ARC is a two-component code. The first component, depicted by a letter between A and E, corresponds to the Aircraft Approach Category of the design aircraft for that airport. The second component, depicted by a Roman numeral between I and VI, corresponds to the Airplane Design Group (ADG) of the design aircraft (see the table on the previous page).

Throughout the 1960's and 70's, the BDI Airport had scheduled airline service. The serving airlines used jet airliners such as the Douglas DC-9 and Boeing 727. Planning efforts in the 1970's anticipated that scheduled jet service would continue and that the airport would ultimately be served by wide-body airliners such as the Boeing 747. Although the ARC system did not exist during the 1970's, BDI would have been given an ultimate designation of ARC D-V, to accommodate the Boeing 747.

There is currently no scheduled airline service at BDI. However, the potential for future airline service is present, assuming that improvements are made to the airport facilities and that the County's economy continues to grow. Current commuter airlines are using smaller aircraft to serve smaller communities, with connector flights to larger cities. These aircraft include the Saab SF-340, Beechcraft 1900, and Fokker F-27, all of which are ARC B-II types.

Most of the business jets which currently use the BDI facility are ARC B-I types such as the Lear 28, Sabreliner NA-265-40, and Cessna Citation I, ARC B-II types such as the Falcon 20, Falcon 50, and Sabreliner NA-265-65, ARC C-I types including the Lear 23 and Lear 25, and ARC C-II models such as the Gulfstream III.

Available Existing Activity Forecasts for BDI

The establishment of an accurate basis for forecasting of future aviation activity is of primary importance in any planning effort. The recommended practice is to begin with the examination of prior estimates and forecast figures.

In an attempt to arrive at a reasonable estimate of current usage of the

BDI Airport and to facilitate development of accurate independent forecast estimates, a review of available data was made.

The data sources examined included the following:

- [1] National Plan of Integrated Airport Systems (NPIAS) 1993-1997, Federal Aviation Administration - April, 1995.
- [2] 1995 Arizona State Aviation Needs Study (SANS), Arizona Department of Transportation - Bucher, Willis & Ratliff - November, 1995.
- [3] Cochise County Airport System Plan - 1994, Cochise County Board of Supervisors - The WLB Group, Inc. - March, 1994.

Estimates of existing operations and based aircraft for the BDI Airport were developed for and approved by the Federal Aviation Administration and the State of Arizona, and are documented in each of the above referenced publications.

National Plan of Integrated Airport Systems (NPIAS) Forecasts for BDI

The National Plan of Integrated Airport Systems, or NPIAS, contains projections of total based aircraft for all airports included in the Plan. The latest NPIAS update (reference 1 above) indicates that 33 aircraft will be based aircraft at BDI by 1997.

The NPIAS includes a budget amount of $1,174,000 for airport improvements at BDI during the 1993-97 planning period, and classifies BDI as a "GA" (General Aviation) facility.

The NPIAS does not list the number of existing based aircraft (which is, at least in part, the basis of FAA projections). However, the FAA Form 5010 records indicate 29 based aircraft at BDI in July of 1995. The source of the Form 5010 information is not given.

The NPIAS does not include forecasts of annual operations.

1995 Arizona State Aviation Needs Study Forecasts for BDI

The 1995 Arizona State Aviation Needs Study, or SANS, (reference 2 above) includes projections of based aircraft and annual operations for each County and for each specific public-use airport in Arizona, including the BDI airport.

The SANS indicates the following for the three key public-ownership/public-use Cochise County airports within the overlapping BDI service area:

SANS Airport Activity Projections for Cochise County and BDI Service Area Airports

	1995	2000	2005	2010	2015
Cochise County					
Based Aircraft	130	141	150	161	169
Bisbee-Douglas Intl.					
Based Aircraft	10	10	11	12	13
Operations	1,946	1,946	2,141	2,335	2,530
Bisbee Municipal					
Based Aircraft	12	13	14	15	16
Operations	7,610	8,245	8,879	9,513	10,147
Douglas Municipal					
Based Aircraft	20	20	21	21	22
Operations	7,459	7,459	7,832	7,832	8,205

Source: 1995 SANS

It is immediately apparent that the number of based aircraft shown in the SANS for BDI is in error. There are actually 24 aircraft currently based at BDI. The inventory conducted in 1992 for the Cochise County Airport System Plan indicates that there were 24 based aircraft at that time. An inventory conducted in 1983 by the current BDI Master Plan consulting team also indicated 24 aircraft. The SANS notes that the source of its baseline data was the FAA Form 5010 records, which indicate 29 based aircraft at BDI (July, 1995).

Although the level of annual operations at BDI is undoubtably dampened by the current deteriorated condition of the airport, the SANS estimates (which are at least partially based on the number of based aircraft) appear to be low.

1994 Cochise County Airport System Plan Forecasts for BDI

The Cochise County Airport System Plan (1994) also includes projections of based aircraft and operations for the County's airports. The County plan indicates the following for the three key public-ownership/public-use airports within the BDI service area:

Cochise County Airport System Plan
Activity Projections for Cochise County
and BDI Service Area Airports

	1992	1997	2002	2007	2012
Cochise County					
Based Aircraft	151	181	210	239	270
Bisbee-Douglas Intl.					
Based Aircraft	24	25	27	28	30
Operations	6,000	7,500	8,100	8,400	9,000
Bisbee Municipal					
Based Aircraft	17	20	22	25	29
Operations	3,600	5,000	6,050	6,875	8,700
Douglas Municipal					
Based Aircraft	26	29	33	38	43
Operations	12,000	14,500	17,325	20,900	25,800

Source: 1994 Cochise County Airport System Plan

The Cochise County Airport System Plan projections for BDI appear to be the most realistic in terms of numbers of based aircraft, and the estimated number of operations for 1992 is probably reasonable, considering the current condition of the airport. The projected future number of operations for BDI may be inordinately low, assuming an improved facility with good business growth potential.

ESTIMATED CURRENT ACTIVITY AT BDI

The level of activity at BDI is currently dampened as a result of the condition of the airport's pavement and other infrastructure. Although BDI has over 7,300' of runway available, with unobstructed airspace and a published instrument approach, transient operators of larger aircraft (and many smaller aircraft) prefer to use the Douglas

Municipal or Bisbee Municipal airports. It is certain that after improvements are made, BDI will experience an immediate increase in activity by transient aircraft as well as an increase in the number of based aircraft.

For this reason, two estimates of existing activity have been prepared. The first is a depiction of the Actual Current Activity, as presently dampened by the airfield's condition. The second is an estimate of the Potential 1997 Activity at BDI at the present time, assuming that runway, taxiway and other improvements are made, and that a concerted effort is made to attract business and sport aviation to the airport.

The estimate of Actual Current Activity is based upon available local information, short-term traffic observations, and survey responses of the based aircraft owners.

The estimate of Potential 1997 Activity assumes that the BDI Airport has the potential to operate at the level of an average U.S. general aviation airfield with good business potential and a sound local economy.

Average Operations per Based Aircraft: Multiple Airport User Surveys

In the process of preparing numerous airport master plans for U.S. general aviation airports, an extensive database of information regarding aircraft operations has been accumulated. Over the years, airport user survey questionnaires have been distributed to aircraft owners who base their aircraft at 21 different airports. These questionnaires made inquiry as to the number of total operations performed by each aircraft and give a good indication of the probable level of use of private general aviation aircraft at BDI after improvements are made.

In the surveys, it was found that airports with a very high level of training operations, such as Buffalo, Minnesota and Rexburg, Idaho, have the highest use per based aircraft. The same is true of airports in communities with heavily tourism-based economies, such as Brainerd and Cloquet, Minnesota.

The BDI Airport's aircraft owners responded with the lowest use of their aircraft (30). In contrast, the Douglas Municipal Airport's based aircraft owners indicated 138 average annual operations per based aircraft.

The results of the surveys, in terms of total annual operations by based aircraft, are summarized below.

Airport User Surveys 1988-1996
SUMMARY OF BASED AIRCRAFT OPERATIONS

AIRPORT	YEAR	Annual Ops
Sawyer County Airport (WI)	1988	208
Buffalo Municipal Airport (MN)	1989	481
Mora Municipal Airport (MN)	1989	232
Two Harbors Municipal Airport (MN)	1989	275
Rusk County Airport (WI)	1989	97
Chippewa Valley Regional Airport (WI)	1990	217
Cumberland Municipal Airport (WI)	1990	220
Canby Municipal Airport (MN)	1991	118
Glencoe Municipal Airport (MN)	1991	119
Portage Municipal Airport (WI)	1992	360
Rush City Municipal Airport (MN)	1992	116
Thief River Falls Regional Airport (MN)	1992	194
Brainerd-Crow Wing County Regional (MN)	1990	566
Cambridge Municipal Airport (MN)	1993	115
Cloquet Municipal Airport (MN)	1993	410
Red Wing Municipal Airport (MN)	1994	128
Rexburg - Madison County Airport (ID)	1994	427
Pershing County - Derby Field (NV)	1993	205
Douglas Municipal Airport (AZ)	1994	138
Baudette International Airport (MN)	1994	64
Bisbee-Douglas International Airport (AZ)	1996	30
Average Annual Operations by Each Based Aircraft:		**225**

Actual Current Activity Estimate

In order to estimate the Actual Current Activity at the BDI Airport, in its present condition, the following assumptions and calculations were made:

- Although there are 24 aircraft based at BDI, three are not currently operational. The Martin 404 and a Cessna 175 are not in airworthy condition at the present time, and a Sprint-II homebuilt single is currently under construction.

- The number of *annual operations by based aircraft* was calculated by multiplying the user survey average (30) by the number of currently active aircraft (21). The user survey average was applied to the 3 multi-engined aircraft as well as the 15 single-engine aircraft and 3 ultralights.

- The total number of annual operations were estimated by reference to an informal record of traffic observations kept by airport management staff. This log included 199 days of record within the period between June 11, 1994 and May 20, 1995. The records include only a rough tally of observed operations, and is limited to the hours of 8:00 to 4:30 PM.

  There are 957 total operations recorded in the log. This extrapolates to an average of about 5 recorded operations per day. In order to approximate the total annual operations at BDI from this log, the approximate average of 5 operations per day was increased by a factor of 1.5 to account for activity in the morning hours prior to 8:00 AM and evening hours after 4:30 PM, as well as activity which may have been missed by management staff. The daily average was again increased by a factor of 1.15 to account for night activity.

  The resulting daily average is about 9 operations per day, or about 3,285 annual operations (9 X 365). Note that this is a very rough approximation based on available data.

- The mix of transient aircraft was determined by an examination of the airport manager's fuel service records for October, 1994 through September, 1995. These records document activity by 237 aircraft, which were divided by type as follows (single and multi-engined piston types were not always differentiated in the logs):

Fixed-Wing Piston	69%
Jet	23%
Helicopter (Civilian)	5%
Helicopter (Military Turbine)	3%

The Actual Current Activity at BDI was approximated as follows, based on the above criteria:

Actual Current Activity
Bisbee-Douglas International Airport
1996

Type of Aircraft Operation	Based	Transient	TOTAL
Fixed-Wing Piston	540	1,832	2,372
Jet	0	611	611
Helicopter (Civilian)	0	132	132
Helicopter (Military Turbine)	0	80	80
Ultralight	90	0	90
TOTAL	630	2,655	**3,285**

Potential 1997 Activity Estimate

It was assumed that rehabilitation of the airport infrastructure will foster an immediate increase in the aeronautical activity at BDI. With an aggressive marketing focus by the County, it is not at all unlikely that the BDI airport will become the leading general aviation facility in the area. Levels of activity could quickly reach the national averages for a rural business-oriented airfield.

This potential increase is assumed to occur soon after the initial runway, taxiway, apron and related infrastructure improvements are made, possibly within 1997-1998. The Potential 1997 Activity level is the minimum level that the initial improvements should be designed to accommodate.

The Potential 1997 Activity was estimated as follows:

- The assumption was made that all 24 currently based aircraft will be functional by the time initial airport improvements are made.

- The estimated number of annual local, itinerant, and total operations were calculated by application of the empirical airport activity equations derived from 1995 research of airport activity within 24 Metropolitan Service Areas in the FAA Great Lakes Region (A Method of Estimating Annual Aircraft Operations at Non-towered Airfields, Nicholas J. Pela & Associates - June, 1995). The summary report of the basis of the research from which the equations were derived is included at the end of this section.

  The equations are as follows:

  x = Number of Based Aircraft

  y_t = Total Annual Operations
  y_l = Annual Local Operations
  y_i = Annual Itinerant Operations

  $$y_t = 13{,}321 + 515x - 0.053x^2$$
  $$y_l = 4{,}933 + 268x - 0.039x^2$$
  $$y_i = 8{,}388 + 247x - 0.014x^2$$

- The User Survey activity estimate average for 21 U.S. general aviation airports (including BDI) was used to indicate the current average number of *annual based operations per resident aircraft* (225) for the Fixed-Wing Piston aircraft. The ultralights are typically flown less than conventional fixed-wing aircraft. An arbitrary number of 50 annual operations was used to model this.

- The average number of *transient operations per based aircraft* was calculated as the difference between the total operations per based aircraft and the average annual based operations per resident aircraft. Thus, *total transient operations* were computed as: *Total Annual Operations - 225(Total Based Aircraft)*

- The mix of various types of transient aircraft was based on the FAA's 1994 records of hours flown by the U.S. aircraft fleet, differentiated by type as follows:

Fixed-Wing Piston	18,700,000 hrs	81.3%
Jet and Turboprop	2,400,000 hrs	10.5%
Piston Rotorcraft	400,000 hrs	1.7%
Turbine Rotorcraft	1,500,000 hrs	6.5%

The Potential 1997 Activity has been estimated as follows, based on the above criteria. The forecasts which follow will use this estimate as the basis of projections.

Potential 1997 Activity
Bisbee-Douglas International Airport

TOTAL ANNUAL OPERATIONS			**25,650**
Annual Local Operations			11,343
Annual Itinerant Operations			14,308
Type of Aircraft Operation	**Based**	**Transient**	**TOTAL**
Fixed-Wing Piston	4,725	16,890	21,615
Jet and Turboprop	0	2,181	2,181
Piston Rotorcraft	0	353	353
Turbine Rotorcraft	0	1,350	1,350
Ultralight	150	0	150
TOTAL	4,875	20,775	**25,650**

FORECAST METHODOLOGIES

Although various types of statistical sampling and mathematical models are employed in most forecast methodologies, forecasting future aviation activity must take a more subjective than objective approach. The planner must rely on experience and sound judgement to provide

a subjective evaluation of the results of any forecast, whatever method is used.

In the 1970's and through most of the 1980's, wide use of linear regression models was employed as an effective forecasting tool. These models worked well because aviation was exhibiting steady growth along with most other demographic indicators. In the mid-1980's, however, the aviation industry began to change. The steady growth which began in the 1940's and 1950's suddenly slowed and then began to decline as aircraft manufacturers stopped production of most light aircraft. This initial decline was in response to a recession economy, but the aviation industry did not recover when the economy improved. Manufacturers were hesitant to produce light aircraft because of increased liability exposure, which was made evident after several successful lawsuits were brought against them. These multi-million dollar lawsuits involved accidents which the litigants claimed resulted from design flaws in the involved aircraft. The aircraft involved were models which had, in some cases, been in production for 30 or more years. The judgements claimed that the manufacturer was responsible for the perceived safety of their product even after this length of time. The recent liability reform legislation, which was passed into law in 1995, has provided the aviation industry with some relief from the burden of increasing liability exposure. In response to this, Cessna Aircraft has resumed production of its 172, 182 and 206 models. Piper Aircraft is also producing several models in its Cherokee line. It appears as though the aviation industry is at a turning point, and that a reversal of the decade-long decline may be at hand.

Although the outlook for the general aviation industry is good, the historical data can no longer be successfully applied in the mathematical models as it was in the past.

COCHISE COUNTY DEMOGRAPHICS

As part of the data collection and research for this master planning project, records of Cochise County demographics were collected. These are listed for reference in the Summary of Historical Data on the following page.

Record data for population, per capita income, total employed persons, numbers of registered aircraft, and the number of full and part time jobs in Cochise County were collected from various sources. The sources of the data are referenced in the summary tabulation.

Summary of Historical Data
Cochise County and Bisbee-Douglas International Airport

YEAR	County Population [1]	County Per Capita Income [1]	Number of Employed Persons [7]	County Full & Part Time Jobs [1]	County Registered Aircraft [3]	BDI Based Aircraft	BDI Share of County Aircraft
1970	62,800	$3,422	15,300		65		
1971	67,100	$3,751	19,050		85		
1972	70,900	$3,969	20,325		97		
1973	74,600	$4,253	21,175		74		
1974	76,200	$4,536	18,700		119		
1975	76,900	$4,717	17,900		120		
1976	78,900	$5,058	18,300		139		
1977	80,700	$5,332	18,900		145		
1978	83,200	$5,938	20,700		157		
1979	86,300	$6,218	20,900		160		
1980	86,300	$7,081	21,400		183		
1981	88,200	$7,738	21,400		199		
1982	88,400	$8,139	21,100		208		
1983	89,400	$8,766	21,200	34,321	211	24 [6]	11.4%
1984	91,100	$9,408	22,000	35,455	202		
1985	90,900	$10,053	23,700	37,103	206		
1986	93,100	$10,491	24,800	38,357	179		
1987	95,800	$10,919	31,150	39,204	200		
1988	95,900	$11,539	31,800	39,504	199		
1989	97,200	$11,952	33,410	39,989	194		
1990	98,100 [7]	$12,738	26,738	40,849	181		
1991	99,575 [7]	$13,428		39,469	174 [4]		
1992	101,175 [7]	$14,285		40,744	129 [4]	24 [2]	
1993	103,325 [7]	$14,632		41,556	131 [4]	24 [2]	18.3%
1994	108,225 [7]	$14,764	37,680 [7]	42,849	130 [4]	24 [2]	18.5%
1995	112,300 [7]				130 [4]	(29 [8])	(22.3%)
1996						24 [5]	

[1] Source: U.S. Department of Commerce - Bureau of Economic Analysis (unless noted otherwise).

[2] Source: Cochise County Airport System Plan, 1994.

[3] Source: FAA Census of Civil Aircraft, 1970-1989 (unless otherwise noted).

[4] Source: Arizona DOT/ Aeronautics Division Records (registered).

[5] Source: 1996 Inventory (actual).

[6] Source: Arizona Airports Activity Survey 1982-1983 (actual).

[7] Source: Arizona Department of Economic Security (unless noted otherwise).

[8] Source: FAA Form 5010 (1995)

( ) Indicates questionable or approximate data.

From 1970 through 1983, the number of registered aircraft in Cochise County increased at an average rate of +9.5% annually. However, from 1983 until 1994, the number of registered aircraft has declined at an average rate of about -4.3% per year. This is possibly a reflection of the national aviation industry trends discussed above.

During the 1970-1983 period, County population increased at an average rate of +2.8% per year. This trend continued at the rate of about +1.8% per year through 1994.

County per capita income increased at an average annual rate of +7.5% from 1970 to 1983, then at an average rate of +4.9% per year through 1994.

The number of employed persons in Cochise County increased at an average annual rate of +2.6% from 1970 to 1983, then at an average rate of +5.4% through 1994.

Based Aircraft at BDI

Although the total number of registered aircraft in the County has declined since 1983, the number of based aircraft at BDI has remained constant for several years. Independent inventories conducted in 1982, 1983, 1992 and 1996 have each indicated 24 based aircraft. This has occurred despite the deterioration of the airport facilities over recent years.

During the 1983 through 1994 period, BDI's share of Cochise County's aircraft has increased from 11.4% to 18.5% as the number of aircraft in the county has declined.

FORECAST ASSUMPTIONS

At the present time, about 19% of the County's registered based aircraft are based at BDI. The airport's service area encompasses about 27% of the County's population (approximately 30,000 people), including the cities of Bisbee and Douglas and surrounding unincorporated rural areas. There are three public-use airports within the BDI service area. These are Bisbee Municipal, Douglas Municipal and BDI (Cochise College allows no based aircraft other than those owned by the college). According to FAA Form 5010 records there are currently (1995) 60 based aircraft at the three airports noted above. It is a valid assumption that, all things being equal, the number of based aircraft within this overlapping service area might be evenly split between the three facilities (30 based aircraft per airport). If BDI

becomes the leading general aviation airport in the area, it may follow that the majority of these based aircraft would gravitate toward BDI.

In the forecasts, it has been assumed that the current condition of the BDI facilities is a major factor in the existing low utilization of the airport. The planned improvement of runways, lighting, buildings, maintenance and services in the short term will, it is assumed, cause an immediate increase in the level of activity at the airport. This will include an increase in the number of based aircraft, as well as in operations by both based and transient aircraft. This "jump" in activity in the short term has been modeled by assuming that the number of based aircraft at BDI will increase to 1/3 of the current total number of registered aircraft at the three key public-ownership/public-use airports in the service area (30) by the year 2000. It is assumed that the aircraft added by 2000 will include one Jet or Turboprop aircraft.

FORECAST OF BASED AIRCRAFT

The selected methodology, ADM v7.02 (Airport Demand Model), considers the relationship between aviation activity, population and a selected economic indicator. The assumption is made that, with a constant economy, general aviation activity will vary directly with population. In theory, when the economy improves a larger percentage of income is available to be used for acquisition of aircraft and for aviation-related activities.

The figure which represents the difference between economic growth and corresponding demand in a particular industry is called the elasticity index. In theory, if an airport is realizing its potential in terms of utilization by its service area, a computed elasticity index will approximate the national average.

The ADM program analyzes historic data for a selected period and computes average growth indices for population and the economic indicator, and a representative elasticity index. The number of based aircraft is then multiplied by the growth indices and the elasticity index for each successive year.

The most significant indicator for based aircraft projections at BDI is the increase in market share of the Cochise County aircraft. As mentioned above, during the 1983 through 1994 period, BDI's share of Cochise County's aircraft has increased from 11.4% to 18.5% as the number of aircraft in the county has declined. This percentage of

aviation market share was used as a surrogate for growth potential at BDI. The selected economic indicator was per capita income in Cochise County. A Demand Elasticity Index of 0.91 was computed using these indicators combined with County population.

The forecast of based aircraft for BDI is presented below.

Forecast of Based Aircraft
Bisbee-Douglas International Airport 1997-2016
Assuming Significant Airport Improvements

Type	1997	2002	2007	2012	2016
Fixed-Wing Piston	21	29	37	45	54
Jet and Turboprop	0	1	2	2	2
Piston Rotorcraft	0	0	0	0	0
Turbine Rotorcraft	0	0	0	0	0
Ultralight	3	4	5	6	7
TOTAL	**24**	**34**	**44**	**53**	**63**

FORECAST OF ANNUAL OPERATIONS

The potential number of local, itinerant, and total annual operations was estimated by applying the empirical airport activity equations derived from 1995 research of airport activity within 24 Metropolitan Service Areas in the FAA Great Lakes Region (A Method of Estimating Annual Aircraft Operations at Non-towered Airfields, Nicholas J. Pela & Associates - June, 1995). The equations were applied to the numbers of based aircraft computed by the ADM methodology. The results of the forecasts follow.

Forecast of Annual Operations
Bisbee-Douglas International Airport 1997-2016
Assuming Significant Airport Improvements

	1997	2002	2007	2012	2016
Fixed-Wing Piston Aircraft	21	29	37	45	54
Jet or Turboprop Aircraft	0	1	2	2	2
Ultralight Aircraft	3	4	5	6	7
Total Based Aircraft	**24**	**34**	**44**	**53**	**63**
Total Itinerant Operations	14,308	16,770	19,229	21,440	23,893
Total Local Operations	11,343	14,000	16,649	19,027	21,662
Total Annual Operations	**25,650**	**30,770**	**35,878**	**40,467**	**45,556**
Based Operations by Type:					
Fixed-Wing Piston Aircraft	4,725	6,525	8,325	10,125	12,150
Jet or Turboprop	0	225	450	450	450
Ultralight	150	200	250	300	350
Transient Operations by Type:					
Fixed-Wing Piston Aircraft	16,890	19,365	21,832	24,058	26,508
Jet or Turboprop	2,181	2,501	2,820	3,107	3,424
Piston Rotorcraft	353	405	457	503	554
Turbine Rotorcraft	1,350	1,548	1,745	1,923	2,119
Ultralight	0	0	0	0	0
Total Transient Operations:	20,775	23,820	26,853	29,592	32,606
Total Annual Operations	**25,650**	**30,770**	**35,878**	**40,467**	**45,556**

QUALIFICATION OF RESULTS

Because virtually all aviation growth indicators for the State of Arizona and Cochise County record a downward trend from 1983 until the present, traditional regression analysis was not useful for the purposes of this study. As mentioned above, the number of based aircraft at BDI has remained fairly constant throughout this downward trend in the aviation industry, despite the severe deterioration of the airport's infrastructure. Because of this apparent interest in aviation by the users of the airport, and the tenacity of the flying public to continue to utilize the BDI site in its present condition (even though other airports are available within reasonable driving distances), an optimistic forecast has been presented.

It is important to emphasize that the forecasts represent the probable maximum level of activity at BDI. In order for this level to be realized, the Cochise County Board of Supervisors must commit adequate staff and budget resources to not only improve and upgrade the airport infrastructure, but to also launch an aggressive marketing plan aimed at attracting a qualified Fixed Base Operator, as well as aviation-related business enterprises which will benefit from the unique attributes of the BDI Airport siting opportunities, climate, and location.

The fact that the number of based aircraft at BDI have remained stable while total operations have declined is evidenced by comparison of independent inventories conducted during 1983 and in 1994. The inventory of airport facilities conducted in 1983 (the Arizona Airport Activity Survey 1982-83 of 30 General Aviation Airports, conducted by the present consultant team) indicates that 99,619 gallons of aviation fuel were sold during calendar year 1982. Examination of the current airport management records of fuel sales for October, 1994 through September, 1995 indicates that only 26,212 gallons were sold.

The 1983 inventory included a two-week automated observation of aircraft activity. This indicated 649 total operations, with 570 piston operations, 78 jet operations and 1 rotorcraft operation recorded over the 14-day period. 1,608 gallons of aviation fuel were dispensed during the same 14-day period, or about 1.6% of total annual fuel sales. The 1983 study extrapolated this to indicate about 40,200 annual operations ($1,608 \div 99,619 = 0.01614$ *..and..* $649 \div 0.01614 = 40,207$). In retrospect, this may have been an overly optimistic estimate, but it serves to illustrate the fact that the BDI facility was, in fact, a vital and quite active regional airport in the recent past.

The activity at the BDI Airport in 1983 may be viewed as a "snapshot" of the airport's potential in a relatively strong aviation economy, when the airport facilities were in much better condition than they are at the present time.

If the 1983 study's estimate of annual operations is accepted as a "high-end" estimate of past activity at BDI, a "low-end" estimate should also be useful in validating the present work. This was approached as follows: If the current (1996) estimate of 3,285 total annual operations is accepted as valid and reasonable, using the fuel sales records the extrapolation may be made that there were at least 12,485 total annual operations in 1983 (26,212÷99,619 = 0.2631 *..and..* 3,285÷0.2631 = 12,485).

In conclusion, the 1983 study's "high-end" estimate is 40,200 annual operations. The "low-end" estimate for the same period, based on the current work, is 12,485 annual operations. The mean of this range is about 26,340 annual operations, which is very close to the Potential 1997 Activity estimate of 25,650 annual operations.

The results of the forecasts are presented in Figure 3-1 at the end of this section, along with comparisons to the NPIAS, Cochise County Airport System Plan, and SANS forecasts, demographic indicators, and other comparative data.

Critical Aircraft Determination

The "critical", or "design", aircraft for any given airport facility is defined as that aircraft (or group of aircraft) whose dimensional and/or performance characteristics are the basis for selection of facilities design criteria. The critical aircraft must be demonstrated to account for a minimum of 500 annual actual or forecast operations.

Different aircraft may govern the requirements for runway design, and for lateral and vertical separation standards. The factors usually considered are the aircraft maximum gross takeoff weight, approach speed category, wingspan, and tail height.

The critical aircraft currently using the BDI Airport facilities is a mix of transient ARC B-I, B-II and C-I business jets and turboprops, which account for about 600 annual operations. The Potential 1997 Activity estimates indicate that use by this critical aircraft fleet may potentially increase to over 2,000 annual operations after initial airport improvements are made. Base year airport design criteria should,

therefore, conform to at least ARC C-II category standards.

The forecast indicate that activity by the business jet and turboprops may potentially reach over 3,800 annual operations by the year 2016, and may include use by at least two based jets or turboprops.

A representative "design fleet" of these aircraft is presented in the tables on the following pages. The tables are output files from the AcData v6.10 aircraft database. Runway requirements for the various aircraft were computed based on a density altitude of 6,978', which was derived by using a pressure altitude of 4,100' MSL at 90° Fahrenheit.

The critical aircraft listings indicate that an 8,700' long runway would accommodate all of the selected database aircraft at the 6,978' density altitude. Most of the listed types could be accommodated by the currently available runway length of 7,300'.

Bisbee-Douglas International Airport
Critical Aircraft Design Fleet

ARC B-I JETS

```
P A R A M E T E R S :
DENSITY ALTITUDE     : 6978 MSL
GENERAL TYPE CODE    : Jets
U.S. CUSTOMARY UNITS:  Speed in knots.....Lengths in Feet.....Weight in Pounds

   Greater Than:       90.00      0.00      0.00      0.00      0.00      0.00
   &  Less Than:      121.00     49.00    200.00    100.00 100000.00  10000.00
```

Model	AppSpeed	WingSpan	AClength	TailHite	TOweight	RWindex
Falcon 10	104	42.90	45.50	15.10	14000	3496
Falcon 10	104	42.90	45.50	15.10	16000	4144
Falcon 10	104	42.90	45.50	15.10	18740	5891
Learjet 28/29	120	43.75	47.58	12.25	15000	4495
Learjet 28/29	120	43.75	47.58	12.25	13000	3794
Sabreliner NA-265-40	120	44.50	43.80	16.00	18650	6989
Sabreliner NA-265-60	120	44.50	48.30	16.00	20000	8037
Cessna Citation I/SP	107	47.10	43.50	14.33	11850	4167
Cessna Citation I/SP	107	47.10	43.50	14.33	10000	2983

```
Database contains  465 entries with    9 matched items.

C R I T I C A L   P A R A M E T E R S ==========================================
Runway Length Index.....(    8037) Sabreliner NA-265-60      @   20000 #
WingSpan................(   47.10) Cessna Citation I/SP
Tail Height.............(   16.00) Sabreliner NA-265-40
Aircraft Length.........(   48.30) Sabreliner NA-265-60
Takeoff Weight..........(   20000) Sabreliner NA-265-60
Approach Speed..........(     120) Learjet 28/29
================================================================================
```

Bisbee-Douglas International Airport
Critical Aircraft Design Fleet

ARC B-II JETS

```
P A R A M E T E R S :
DENSITY ALTITUDE     : 6978 MSL
GENERAL TYPE CODE    : Jets
U.S. CUSTOMARY UNITS:  Speed in knots.....Lengths in Feet.....Weight in Pounds

   Greater Than:       90.00     48.99      0.00      0.00      0.00      0.00
   &  Less Than:      121.00     79.00    200.00    100.00 100000.00  10000.00
```

Model	AppSpeed	WingSpan	ACLength	TailHite	TOweight	RWindex
Falcon 20	107	53.50	56.30	17.40	18000	3396
Falcon 20	107	53.50	56.30	17.40	26000	5990
Falcon 200	114	53.50	56.30	17.40	20000	3598
Falcon 200	114	53.50	56.30	17.40	26000	4496
Falcon 200	114	53.50	56.30	17.40	30650	7480
Falcon 50	113	61.90	60.80	22.90	22000	3396
Falcon 50	113	61.90	60.80	22.90	30000	3894
Falcon 50	113	61.90	60.80	22.90	37480	5891
Falcon 900	100	63.40	66.30	24.80	45500	7093
Falcon 900	100	63.40	66.30	24.80	34000	3994
Falcon 900	100	63.40	66.30	24.80	28000	3147
Westwind Astra	110	52.67	55.58	18.17	24650	8639
Westwind Astra	110	52.67	55.58	18.17	23000	6694
Westwind Astra	110	52.67	55.58	18.17	20000	5244
Sabreliner NA-265-65	105	50.50	46.10	16.00	19000	6241

```
Database contains  465 entries with   15 matched items.

C R I T I C A L   P A R A M E T E R S ==========================================
Runway Length Index.....(    8639) Westwind Astra            @   24650 #
WingSpan................(   63.40) Falcon 900
Tail Height.............(   24.80) Falcon 900
Aircraft Length.........(   66.30) Falcon 900
Takeoff Weight..........(   45500) Falcon 900
Approach Speed..........(     114) Falcon 200
================================================================================
```

Bisbee-Douglas International Airport
Critical Aircraft Design Fleet

ARC C-I JETS

```
P A R A M E T E R S :
DENSITY ALTITUDE     : 6978 MSL
GENERAL TYPE CODE    : Jets
U.S. CUSTOMARY UNITS:  Speed in knots.....Lengths in Feet.....Weight in Pounds

   Greater Than:      120.00      0.00      0.00      0.00      0.00      0.00
   &  Less Than:      141.00     49.00    200.00    100.00 100000.00  10000.00
```

Model	AppSpeed	WingSpan	ACLength	TailHite	TOweight	RWindex
Learjet 23	128	35.58	43.17	12.00	12000	6789
Learjet 23	128	35.58	43.17	12.00	10500	4694
Learjet 24B	128	35.58	43.25	12.58	13500	4893
Learjet 24B	128	35.58	43.25	12.58	12000	3944
Learjet 25B/C	137	35.58	47.50	12.50	15000	6289
Learjet 25B/C	137	35.58	47.50	12.50	12000	3600
Learjet 25D/F	137	35.58	47.58	12.25	15000	6198
Learjet 25D/F	137	35.58	47.58	12.25	12000	3944
Learjet 31	129	39.50	48.70	12.30	10000	3840
Learjet 31	129	39.50	48.70	12.30	14000	4419
Learjet 31	129	39.50	48.70	12.30	16500	5909
Learjet 55C	128	43.75	55.08	14.67	21500	7978
Learjet 55C	128	43.75	55.08	14.67	17000	4843
IAI Westwind 1124	129	44.80	52.30	15.80	22850	7277
IAI Westwind 1124	129	44.80	52.30	15.80	21000	5443
IAI Westwind 1124	129	44.80	52.30	15.80	18000	4146
IAI Westwind 1124A	129	44.80	52.30	14.80	23500	7773
IAI Westwind 1124A	129	44.80	52.30	14.80	21000	5493
IAI Westwind 1124A	129	44.80	52.30	14.80	18000	4146

```
Database contains  465 entries with   19 matched items.

C R I T I C A L   P A R A M E T E R S ==========================================
Runway Length Index.....(    7978) Learjet 55C                @   21500 #
WingSpan................(   44.80) IAI Westwind 1124
Tail Height.............(   15.80) IAI Westwind 1124
Aircraft Length.........(   55.08) Learjet 55C
Takeoff Weight..........(   23500) IAI Westwind 1124A
Approach Speed..........(     137) Learjet 25B/C
================================================================================
```

Bisbee-Douglas International Airport
Critical Aircraft Design Fleet

ARC C-II JETS

```
P A R A M E T E R S :
DENSITY ALTITUDE    : 6978 MSL
GENERAL TYPE CODE   : Jets
U.S. CUSTOMARY UNITS:  Speed in knots.....Lengths in Feet.....Weight in Pounds

   Greater Than:      120.00     48.99      0.00      0.00      0.00      0.00
   &  Less Than:      141.00     79.00    200.00    100.00 100000.00  10000.00
```

Model	AppSpeed	WingSpan	ACLength	TailHite	TOweight	RWindex
Gulfstream III	136	77.80	83.10	24.40	69700	7738
Gulfstream III	136	77.80	83.10	24.40	58000	5442
Gulfstream III	136	77.80	83.10	24.40	50000	4193
Lockheed Jetstar	132	54.42	60.42	20.42	34000	6640
Lockheed Jetstar II	132	54.42	60.42	20.42	44500	4948
Lockheed Jetstar II	132	54.42	60.42	20.42	36000	4748
Sabreliner NA-265-80	128	50.40	47.20	17.30	19000	6190
Sabreliner NA-265-80A/SC	128	50.40	47.20	17.30	25500	8088
Sabreliner NA-265-80A/SC	128	50.40	47.20	17.30	20000	4869

```
Database contains  465 entries with    9 matched items.

C R I T I C A L   P A R A M E T E R S ==========================================
Runway Length Index.....(    8088) Sabreliner NA-265-80A/SC  @   25500 #
WingSpan................(   77.80) Gulfstream III
Tail Height.............(   24.40) Gulfstream III
Aircraft Length.........(   83.10) Gulfstream III
Takeoff Weight..........(   69700) Gulfstream III
Approach Speed..........(     136) Gulfstream III
================================================================================
```

Bisbee-Douglas International Airport
Critical Aircraft Design Fleet

ARC B-I MULTI-ENGINE PROPELLER

```
P A R A M E T E R S :
DENSITY ALTITUDE     : 6978 MSL
GENERAL TYPE CODE    : Multi-Engine Propeller
U.S. CUSTOMARY UNITS:  Speed in knots.....Lengths in Feet.....Weight in Pounds

   Greater Than:       90.00      0.00      0.00      0.00      0.00      0.00
   &  Less Than:      121.00     49.00    200.00    100.00 100000.00  10000.00
```

Model	AppSpeed	WingSpan	ACLength	TailHite	TOweight	RWindex
Beechcraft B100	111	45.90	39.90	15.40	11500	5144
Beechcraft B100	111	45.90	39.90	15.40	10000	4494
Cessna 310R	93	36.92	31.96	10.67	5500	5626
Metro III	112	46.20	59.40	16.70	12500	4347
Metro III	112	46.20	59.40	16.70	16000	6393
Metro II SA226-TC	112	46.25	59.42	16.67	12500	4342
Metro II SA226-TC	112	46.25	59.42	16.67	10500	2796
Metro II SA226-TC	112	46.25	59.42	16.67	8500	2172
Cessna 425	103	44.10	35.90	12.60	8600	5050
Cessna 425	103	44.10	35.90	12.60	8200	4909
Cessna 340A	92	38.10	34.30	12.60	5990	4445
Cessna 340A	92	38.10	34.30	12.60	5000	2925
Cessna 402C	95	44.12	36.38	11.45	6850	4839
Cessna 402C	95	44.12	36.38	11.45	5500	2945
Cessna 414A	94	44.10	36.40	11.50	6750	5473
Cessna 414A	94	44.10	36.40	11.50	5700	3711
Cessna 421C	96	41.10	36.40	11.50	7450	4689
Cessna 421C	96	41.10	36.40	11.50	6200	3067

```
Database contains  465 entries with   18 matched items.

C R I T I C A L   P A R A M E T E R S ==========================================
Runway Length Index.....(    6393) Metro III                    @   16000 #
WingSpan................(   46.25) Metro II SA226-TC
Tail Height.............(   16.70) Metro III
Aircraft Length.........(   59.42) Metro II SA226-TC
Takeoff Weight..........(   16000) Metro III
Approach Speed..........(     112) Metro III
================================================================================
```

Bisbee-Douglas International Airport
Critical Aircraft Design Fleet

ARC B-II MULTI-ENGINE PROPELLER

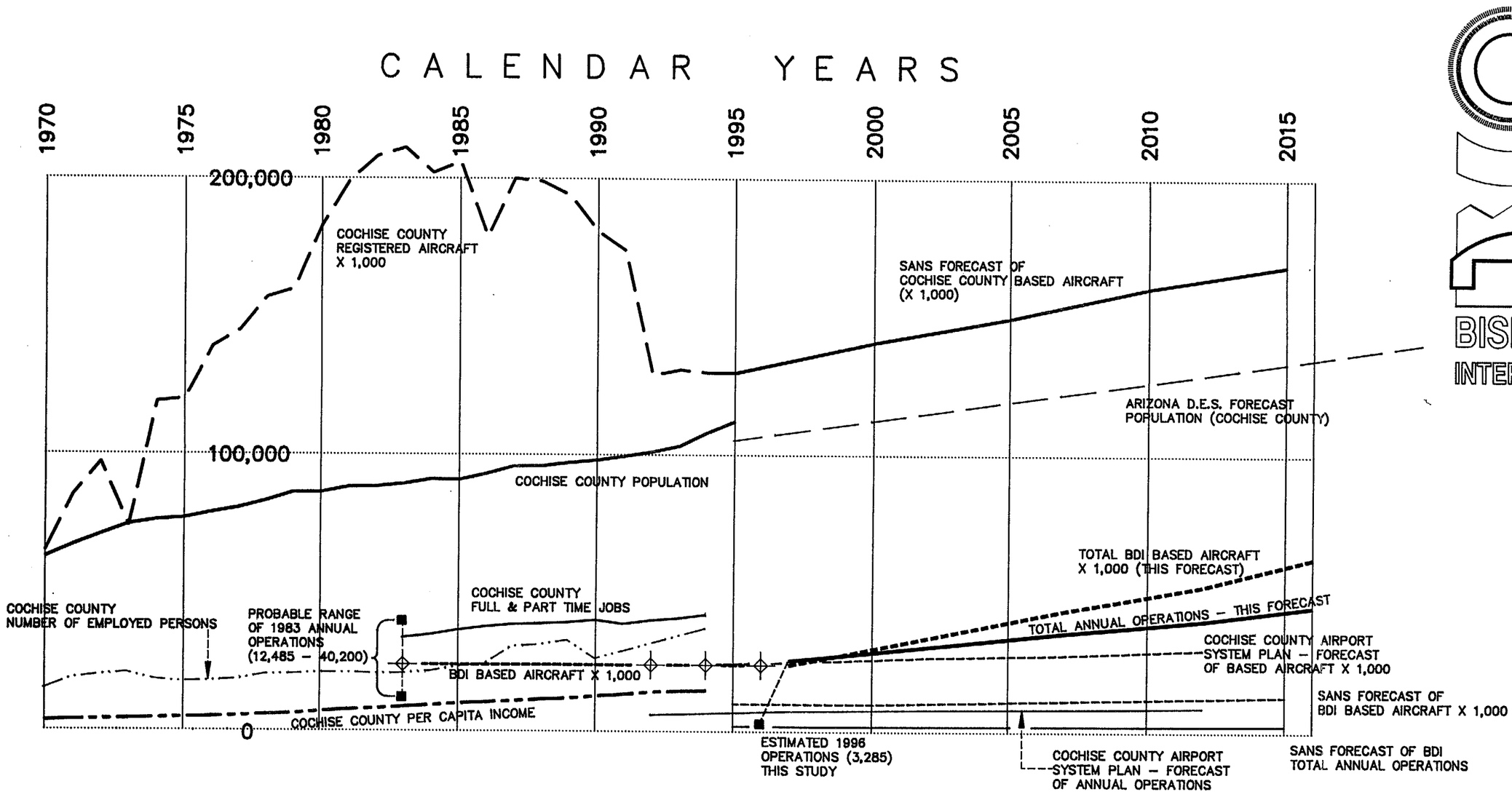
```
P A R A M E T E R S :
DENSITY ALTITUDE    : 6978 MSL
GENERAL TYPE CODE   : Multi-Engine Propeller
U.S. CUSTOMARY UNITS:  Speed in knots.....Lengths in Feet.....Weight in Pounds

   Greater Than:       90.00     48.99      0.00      0.00      0.00      0.00
   &  Less Than:      121.00     79.00    200.00    100.00 100000.00  10000.00
```

Model	AppSpeed	WingSpan	AClength	TailHite	TOweight	RWindex
Beechcraft B200	98	54.50	43.80	15.00	12500	4247
Beechcraft B200	98	54.50	43.80	15.00	11000	3996
Gulfstream I	113	78.30	75.30	23.00	34000	6342
Merlin IVC	113	57.00	59.33	16.67	12500	4323
Merlin IVC	113	57.00	59.33	16.67	16000	6044
Saab 340B	104	70.33	64.67	22.50	30000	7236
Saab 340B	104	70.33	64.67	22.50	25000	4518
Saab-Fairchild SF 340A	104	70.33	64.67	22.50	28000	6690
Saab-Fairchild SF 340A	104	70.33	64.67	22.50	25000	4993
Embraer EMB-120 Brasilia	108	64.90	65.60	20.80	25353	6642
Embraer EMB-120 Brasilia	108	64.90	65.60	20.80	24000	5744
Cessna 441	99	49.30	34.70	12.80	9850	4863
Cessna 441	99	49.30	34.70	12.80	7800	4258

```
Database contains  465 entries with   13 matched items.

C R I T I C A L   P A R A M E T E R S ==========================================
Runway Length Index.....(    7236) Saab 340B                  @   30000 #
WingSpan................(   78.30) Gulfstream I
Tail Height.............(   23.00) Gulfstream I
Aircraft Length.........(   75.30) Gulfstream I
Takeoff Weight..........(   34000) Gulfstream I
Approach Speed..........(     113) Gulfstream I
================================================================================
```



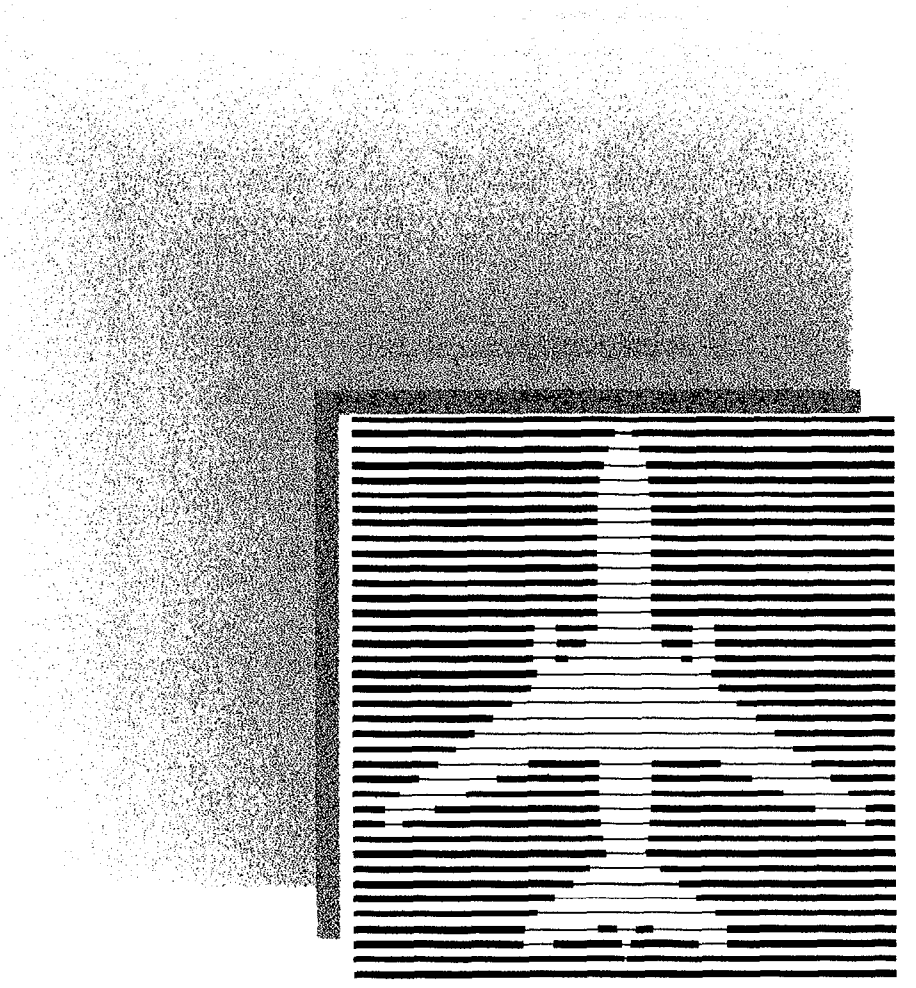
BISBEE-DOUGLAS
INTERNATIONAL AIRPORT

December 10, 1996

Summary of Historical Data and Forecasts

Figure 3-1

A Method of Estimating Annual Operations at Non-towered Airfields



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Cumberland, WI 54829
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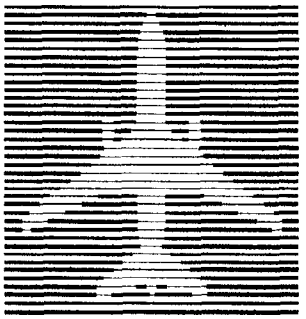
June, 1995



A METHOD OF ESTIMATING ANNUAL AIRCRAFT OPERATIONS AT NON-TOWERED AIRFIELDS

Nicholas J. Pela
June, 1995

Data Collection

In order to form a valid basis for the forecasting model, extensive sets of general aviation activity and demographic indicators were collected. Twenty-four (24) Metropolitan Service Areas (MSA's) in the FAA Great Lakes Region were selected as the model. The MSA's are located in the states of Wisconsin, Minnesota and Michigan. One MSA (Fargo-Moorhead) overlaps into North Dakota. The data for each of the MSA's is presented in Table II.

The MSA demographic indicators were derived from the U.S. Bureau of Economic Analysis (BEA) records. The airports serving each MSA were identified by reference to the FAA National Plan of Integrated Airport Systems (NPIAS). General aviation activity records for each serving airport were derived from the FAA Terminal Area Forecasts (TAF) wherever possible. In the few cases where a serving airport was not included in the TAF, reference was made to the NPIAS for estimates of operations and based aircraft.

The demographic and aviation activity indicator variables are as follows:

MSA Population
MSA Per Capita Income
Local GA Operations
Itinerant GA Operations
Total GA Operations
MSA Based Aircraft
U.S. Per Capita Income

Calendar year 1991 was selected as the base year of the study because of consistency in data availability throughout the selected data sources.

Data Analysis

A computer model was developed which compared the various data, providing a correlation coefficient ("r") and curvilinear regression analysis to derive a second-order polynomial equation to use as the basis of projections.

The raw data gathered from the BEA and FAA sources (population, per capita income, GA operations, and based aircraft) was augmented by calculating the following additional variables:

Per Capita Income Margin *
Aircraft per 1,000 MSA Population
Local Operations Per Capita
Itinerant Operations Per Capita
Total Operations Per Capita
Local Operations Per Based Aircraft
Itinerant Operations Per Aircraft
Total Operations Per Aircraft

* *The Per Capita Income Margin was computed as the average per capita income for the U.S. minus the MSA per capita income.*

The intent of the analysis was to derive a reasonable equation for estimating general aviation operations and, if possible, the number of expected based aircraft. In the analysis, various combinations of independent (x) and dependent (y) variables were modeled.

Very high correlation was found between the number of based aircraft and the level of aircraft activity:

x	=	MSA Based Aircraft	r=
y	=	Total GA Operations	0.9916
y	=	Local GA Operations	0.9801
y	=	Itinerant GA Operations	0.9932

Somewhat lower correlation was found between population and the level of activity:

x	=	MSA Population	r=
y	=	Total GA Operations	0.7508
y	=	Local GA Operations	0.7563
y	=	Itinerant GA Operations	0.7395

No acceptable correlation was found between either of the economic indicators (Per Capita Income and Per Capita Income Margin) and any of the aviation activity indicators. The highest of these was found between Per Capita Income and aircraft activity per capita:

x	=	Per Capita Income	r=
y	=	Local Operations Per Capita	-0.6946
y	=	Itinerant Ops Per Capita	-0.5547
y	=	Total Ops Per Capita	-0.6705

An acceptable relationship for estimating the number of based aircraft for a service area was not found in the analysis. The best correlation found in this area was between population and total based aircraft:

x = MSA Population r=
y = MSA Based Aircraft 0.7090

Conclusions

The highest correlation by far was found between MSA Based Aircraft and the level of aircraft activity. The following equations were derived which should be useful in estimating total operations at a general aviation airfield:

x = Number of Based Aircraft
y = Total Annual GA Operations
$y = 13{,}321 + 515x - 0.053x^2$

x = Number of Based Aircraft
y = Local GA Operations
$y = 4{,}933 + 268x - 0.039x^2$

x = Number of Based Aircraft
y = Itinerant GA Operations
$y = 8{,}388 + 247x - 0.014x^2$

It is obvious that with the use of these equations, the fewest number of total annual operations possible at any airport is about 13,000. In reality this may not hold true. Except in very unique circumstances, a theoretical airport with no based aircraft (no apparent activity) will probably not have any activity at all, and an airfield with very few based aircraft will probably not experience this level of activity. However, in cases where there are as few as 10 based aircraft, the equations yield very reasonable results.

The following spreadsheet and chart illustrate some example calculations:

TABLE I - Example Activity Calculations

Based Aircraft	Local Operations	Itinerant Operations	Total Operations
10	7,609	10,856	18,465
20	10,277	13,322	23,599
30	12,937	15,785	28,723
40	15,590	18,245	33,836
50	18,235	20,703	38,938
60	20,872	23,157	44,030
70	23,501	25,609	49,111
80	26,123	28,058	54,181
90	28,737	30,504	59,241
100	31,343	32,948	64,291
110	33,941	35,388	69,329

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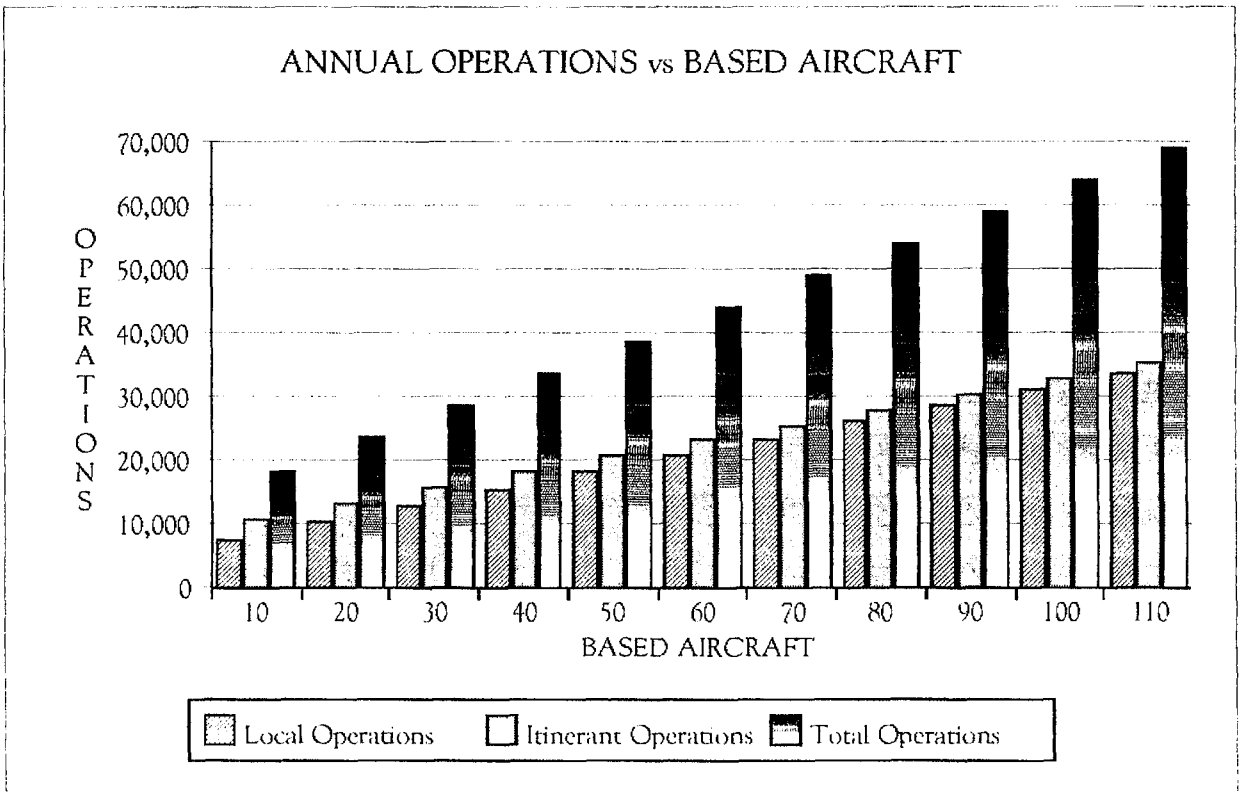

TABLE II - Summary of General Aviation and Demographic Data for 1991

MSA	Total MSA Population	Per Capita Income PCI	PCI Margin	Local Operations	Itinerant Operations	Total Operations	Based Aircraft BAC	Aircraft per 1,000 pop.	Local operations per capita	Itinerant operations per capita	Total operations per capita	Local operations per BAC	Itinerant operations per BAC	Total operations per BAC
Madison MSA	374,700	$20,698	($1,535)	69,900	70,400	140,300	252	0.6725	0.1865	0.1879	0.3744	277	279	556
Appleton-Oshkosh-Neenah MSA	240,600	$16,098	$3,065	52,000	90,000	142,000	251	1.0432	0.2161	0.3741	0.5902	207	358	565
Eau Claire MSA	198,400	$18,684	$479	13,000	29,000	42,000	83	0.4183	0.0655	0.1462	0.2117	156	349	506
Green Bay MSA	139,800	$8,706	$10,457	26,000	28,000	54,000	96	0.6867	0.1860	0.2003	0.3863	270	291	562
Janesville-Beloit MSA	141,100	$17,036	$2,127	39,000	53,000	92,000	120	0.8505	0.2764	0.3756	0.6520	325	441	766
La Crosse MSA	117,000	$17,411	$1,752	24,000	26,000	50,000	95	0.8120	0.2051	0.2222	0.4274	252	273	526
Duluth-Superior MSA	129,300	$7,516	$11,647	48,000	35,000	83,000	124	0.9590	0.3712	0.2707	0.6419	387	282	669
Kenosha PMSA	111,300	$7,879	$11,284	70,000	42,000	112,000	279	2.5067	0.6289	0.3774	1.0063	250	150	401
Racine PMSA	104,400	$17,767	$1,396	13,000	16,000	29,000	62	0.5939	0.1245	0.1533	0.2778	209	258	467
Sheboygan MSA	110,600	$8,197	$10,966	29,000	30,000	59,000	80	0.7233	0.2622	0.2712	0.5335	362	375	737
Milwaukee-Waukesha PMSA	2,582,300	$21,955	($2,792)	114,000	143,000	257,000	610	0.2362	0.0441	0.0554	0.0995	186	234	421
Wausau MSA	3,371,100	$19,224	($61)	47,000	54,000	101,000	105	0.0311	0.0139	0.0160	0.0300	447	514	961
Rochester MSA	109,100	$20,617	($1,454)	27,000	25,000	52,000	47	0.4308	0.2475	0.2291	0.4766	574	531	1,106
St. Cloud MSA	151,200	$14,963	$4,200	39,000	29,000	68,000	82	0.5423	0.2579	0.1918	0.4497	475	353	829
Fargo-Moorhead MSA	155,300	$16,606	$2,557	33,000	44,000	77,000	139	0.8950	0.2125	0.2833	0.4958	237	316	553
Benton Harbor PMSA	161,300	$16,553	$2,610	17,000	25,000	42,000	61	0.3782	0.1054	0.1550	0.2604	278	409	688
Flint PMSA	432,500	$17,798	$1,365	72,000	34,000	106,000	127	0.2936	0.1665	0.0786	0.2451	566	267	834
Lansing-East Lansing MSA	435,600	$17,576	$1,587	58,000	48,000	106,000	219	0.5028	0.1331	0.1102	0.2433	264	219	484
Ann Arbor PMSA	499,300	$20,656	($1,493)	61,000	47,000	108,000	184	0.3685	0.1222	0.0941	0.2163	331	255	586
Grand Rapids-Muskegon-Holland MSA	954,300	$17,987	$1,176	118,000	123,000	241,000	384	0.4024	0.1237	0.1289	0.2525	307	320	627
Jackson MSA	151,200	$15,893	$3,270	29,000	35,000	64,000	113	0.7474	0.1918	0.2315	0.4233	256	309	566
Kalamazoo-Battle Creek MSA	432,900	$17,918	$1,245	62,000	75,000	137,000	276	0.6376	0.1432	0.1733	0.3165	224	271	496
Detroit PMSA	4,288,500	$20,705	($1,542)	354,000	352,000	706,000	1,485	0.3463	0.0825	0.0821	0.1646	238	237	475
Minneapolis-St. Paul MSA	2,582,300	$21,955	($2,792)	381,000	462,000	843,000	2,102	0.8140	0.1475	0.1789	0.3265	181	219	401